JOURNAL

OCTOBER, 1932

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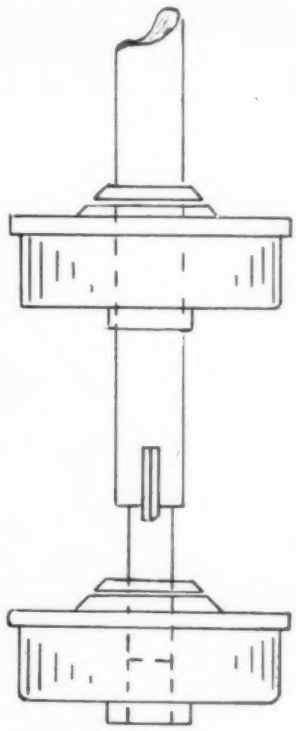

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A. S. T. E. Journal

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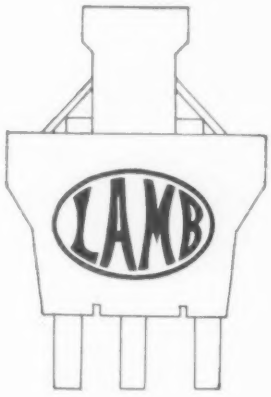

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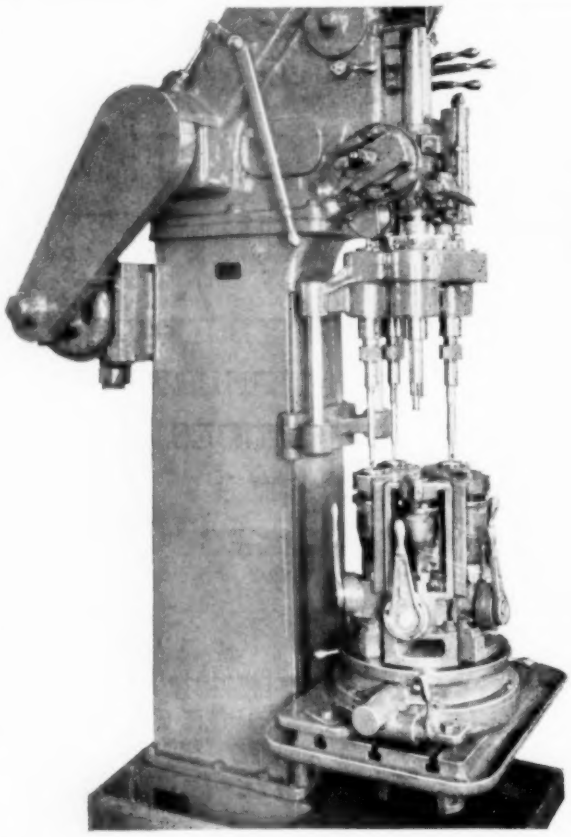

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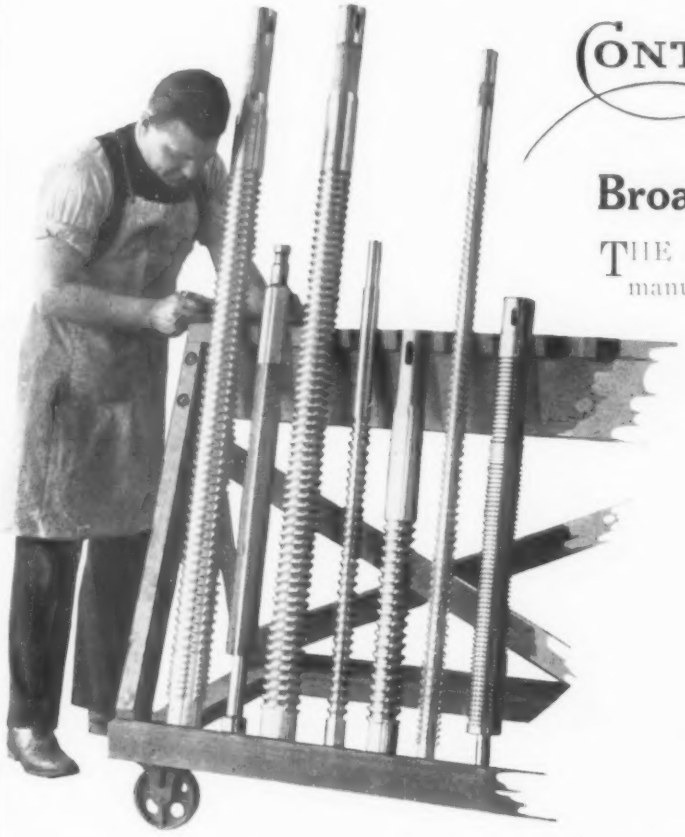

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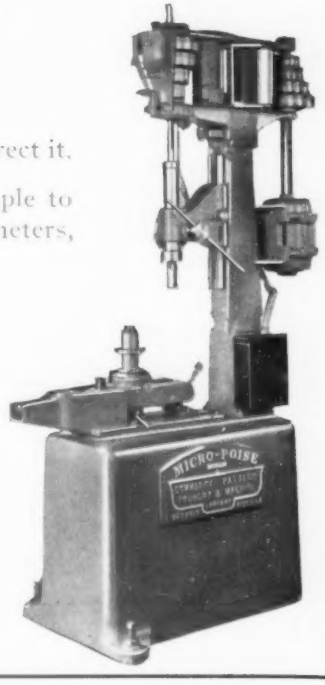

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Next meeting: Thursday, October 13, 1932.
Detroit Leland Hotel,
Colonnade Room,
Eight o'clock.

Speakers:
Tell Berna;

Subject:
The Chronolog.

Dean R. E. Lawrence

Subject:
A Tool Engineer as an Executive.

MR. TELL BERNA

Mr. Tell Berna, who holds the degree of M. E. (Cornell, 1912), is General Sales Manager of the National Acme Company, Cleveland, Ohio. The subject of his talk will be "The Chronolog—The Latest Development and Scientific Management." The Chronolog is an entirely new device representing a means of furnishing to operator, foreman, manager, time-study man, and cost accountant alike, a detailed and accurate record of what is going on at the machine with a view to bringing into high relief the causes of idle time, and making it possible for these various agencies to combat idle time and increase production and profits.

DEAN RUSSELL E. LAWRENCE

Mr. Lawrence gained his Master of Science degree at Rose Polytechnic at Terre Haute in 1913. After working with General Electric Company for three years, and serving the government in the research department of the Signal Corps during the war, Mr. Lawrence began his career at the College of Engineering of the University of Detroit as Dean. Mr. Lawrence has recently severed his connection with the University of Detroit and established the Lawrence Institute of Technology, at 15,100 Woodward Avenue, Highland Park. Mr. Lawrence has chosen as the subject of his talk for our meeting "A Tool Engineer as an Executive."

MEMBERSHIP DRIVE

The Membership Committee of the ASTE announces a concerted offensive on all fronts for new membership. Ten membership drive teams have been organized, each with a chairman in charge, and a fierce race will be run between these teams. Members of the Society may watch the progress of the race in the pages of this Journal. The race course is laid out below, and will be printed each month while the race is in progress. The starting pistol will be fired October 1, and the race will end January 1, 1933. The team recruiting the greatest number of new members in that interval will be the guests of the "also rans" at a big dinner, the plans of which will be divulged later. Full personnels of the teams will be given in next month's Journal.

1. C. B. SMITH, *Chairman*

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EDITORIAL PAGE

DON'T BE A SHRINKING VIOLET

"Mr. Hustler, I have been deputized by the Meeting's Committee of the American Society of Tool Engineers to invite you to present a paper at one of our meetings. We understand that your company has perfected a process which may benefit many of our members."

"Sure, Mr. Inviter, I'll be delighted to tell the ASTE what I know about our process. I'm not an experienced public speaker, but with the help of others at my office I'll prepare the paper and read it. I never pass up an opportunity to advertise my company, my product, or myself."

Mr. Hustler's reply was typical of any go-getter's, who realizes that he has something to sell and an opportunity to serve.

But when Smith John heard the paper read he slyly and ungraciously remarked, "Say, he didn't miss no chance to spread the ole banana oil, did he? Good sales talk, I calls it."

We may have to take a little sales talk besprinkled with the valuable information until we organize a reviewing committee to pre-read each speaker's paper, to the end that the author and the society may each benefit to the greatest extent.

It is recognized by all that the speaker is entitled to all the favorable publicity the Society members and the Journal can give him. This is only his just compensation for the work involved in preparing the paper. It is usually conceded that such compensation is adequate.

In fact, this compensation is so great that it is a matter of no little surprise and disappointment that one of our very good fellow-member-tool engineers failed to accept an invitation to tell the Society about a new development in his plant, with the extraordinary remark, "I'm a worker, not a talker. I don't know enough to make a speech anyway, and besides I'm not a salesman and haven't anything to sell."

Now what do you think of that! Can you imagine this man, here at the birthplace of mass production, in the midst of the greatest concentration of tool engineers in the world, and he himself a man who knows manufacturing as only one who has planned it for years can know it—the man with the wheels in his head and the manufacturing world in the palm of his hand—can you imagine such a lack of perspective? Usually, the reason why a man progresses just so far and then comes to a sudden stop is to be found in analyzing such an outburst.

It is certainly true that he is a worker. But it is time now for him to lift his head to see where his work has carried him. It is true he is not an orator; but 'twere more power to him if he were, and how will he ever become a convincing speaker if he will not talk when asked? "I don't know enough to make a speech." It would seem that if he knew anything at all, he should know enough to take advantage of the opportunity to learn how to make a speech when invited to do so. I know the man personally, and verily I tell you he is an encyclopedia of tool engineering information and can divulge it in a most interesting manner.

The statement that he is not a salesman is true to a certain extent. He would be a production manager if he were more of a salesman. Isn't it tragical to think that such a little thing should so cramp his style! If he should prepare and read just one paper before a large audience it would probably be impossible to keep him from the platform thereafter.

The tragical thing is that he thinks he has nothing to sell. Each of us must sell himself every day, to his wife, his boss, his children, his employees—and *keep himself sold.*

I believe this tool engineer is typical of the average. The average tool engineer is too retiring. He expects someone to "discover" him and put him on a pedestal. He doesn't seem to know that everybody else around him is too busy trying to reach the pinnacle to help anyone else reach it.

This morning one of our unassuming members inadvertently dropped the information to me that he had just completed a paper on a very important tool engineering subject, which he had been hired to write for the chief engineer of a certain company, who was to read it before a sister engineering society's annual meeting. This ASTE member has never been asked by members of his own society to present a paper. Verily, a prophet is not without honor save in his own country.

I know of another of our members who worked from the bottom up, through tool engineering, to the upper stratum, who says he would gladly accept an invitation to talk—because he needs the experience.

If we as a tool engineering society expect to grasp the opportunity of leading the procession of thinkers and workers who are making a science of mass manufacturing, we must stop looking for a Moses or for speakers outside our own ranks. We must learn that no one else is so interested in our success as we are, or should be. After all, with becoming modesty, no one on the outside knows so much about tool engineering as we, hence it is the exchange of our own ideas amongst our several hundred members that is likely to do us the greatest good now.

"Reading maketh a full man; writing an exact man; and talking a ready man." Let's be ready, and when an invitation comes to talk, talk—and if an invitation doesn't come, go out and get one!

AUTOMATIC LOADERS FOR INDIVIDUAL MACHINES OR GROUPS OF MACHINES

Members present at the September 8th meeting of the Society saw a very interesting film showing the operation of Automatic Loaders, as developed and built by the Seneca Falls Machine Company, and built by the SENECA FALLS MACHINE COMPANY, of Seneca Falls, N. Y. MR. E. R. SMITH, Vice President and General Manager of that company, furnished the film and a paper describing the development, both of which were presented by the Detroit representative of the company, Mr. W. H. Nettle.

Since the introduction of tungsten and tantalum carbide tools, the time lost in loading and unloading machines has become of greater importance, because this time has become a much larger per cent of the total operation time.

We should realize that it is just as logical to automatically load work into and out of a lathe as it is to automatically feed bar stock into a screw machine. It is true that feeding rough stock, such as forgings, into a machine where they are to be held between centers, presented some rather difficult problems, but now, that these are worked out, automatic loading and unloading for this class of work should, and no doubt will, take its place along with other advances that have been made in machine shop practice.

The group of machines shown in Fig. 1 is set up for centering (left), rough turning and facing (center), and finish turning and facing (right) automobile steering-gear sector shafts. The rough forgings, approximately 8" long, are delivered by a con-

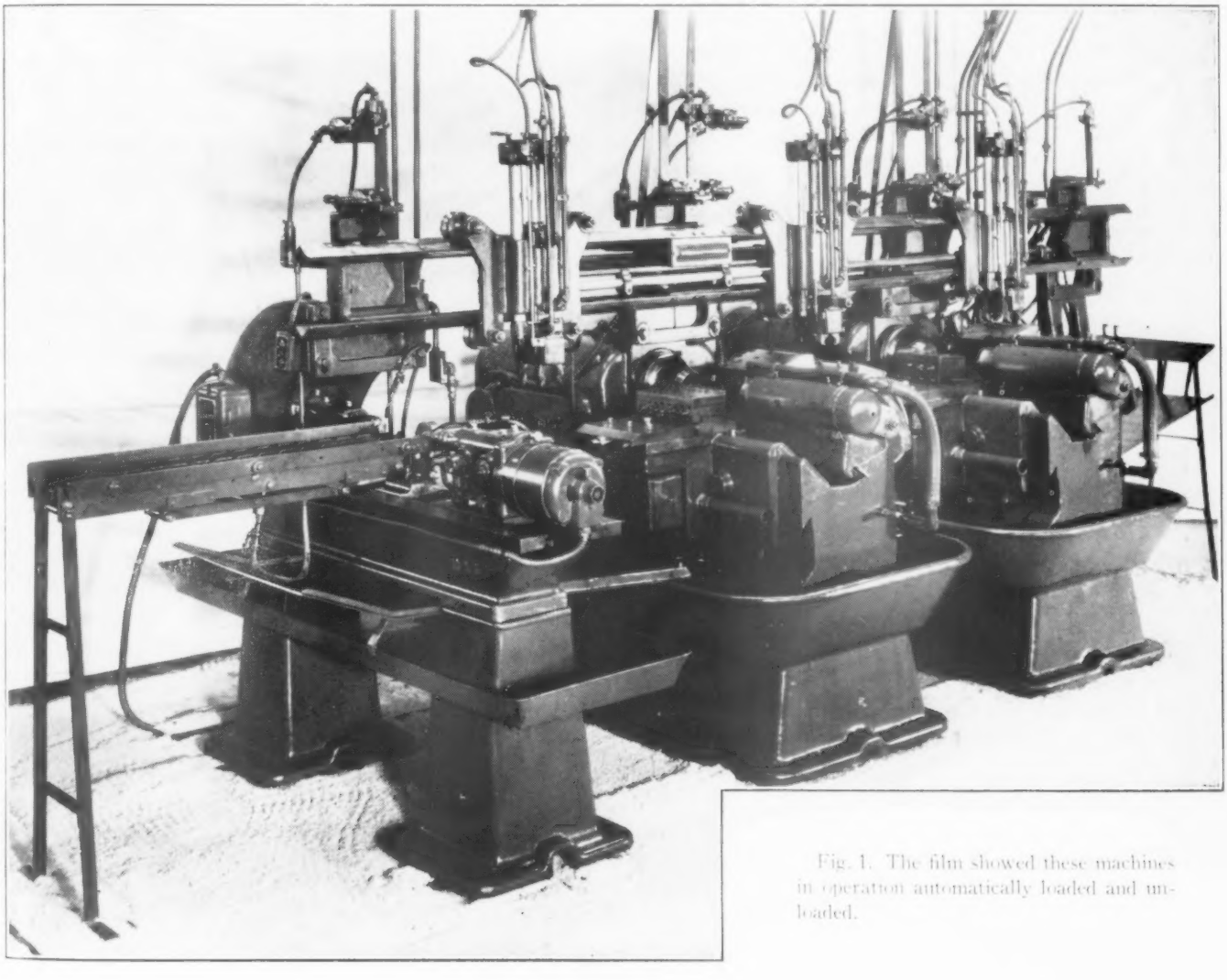


Fig. 1. The film showed these machines in operation automatically loaded and unloaded.

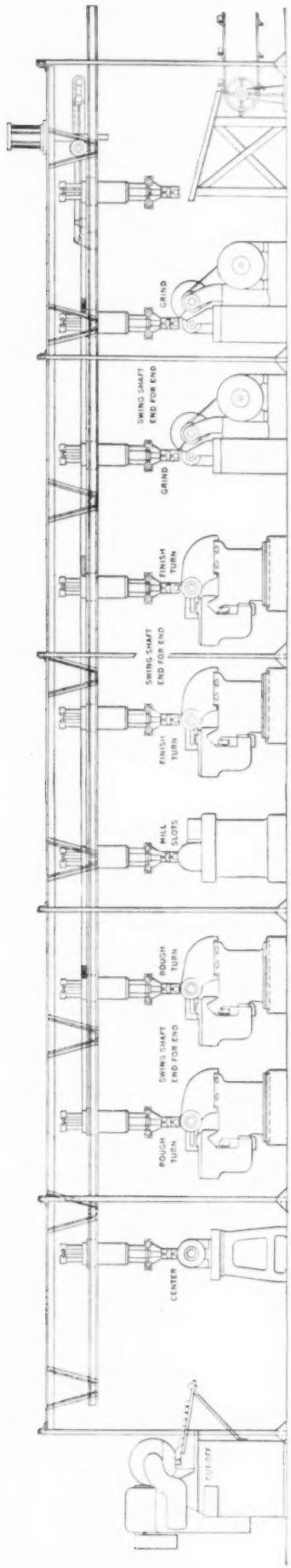


Fig. 2. Hydraulically operated loading equipment designed to serve nine machines simultaneously. Provision is made for turning the work pieces end for end between three of the operations.

veyor to the automatic loader of the centering machine. The three loading heads transfer the parts from each machine to the next, finally delivering the completely finished parts to a chute at the right hand end of the installation, which leads to a conveyor.

COMPLETE SAFETY INSURED BY ELECTRIC SWITCHES

All movements of the three loading heads, their work-transfer fingers, the centering machine loader and clamps, and of the tailstocks on the turning and facing lathes are accomplished by hydraulic equipment. Each movement is absolutely controlled through the use of electric switches and solenoids. It is impossible for any part of the loading heads of the machines to start that makes a movement beforehand has completed that movement. All switches for similar functions are in series so that, for example, the switches that control the tail-stocks on the lathes or the switches that control similar movements of the three loading heads, must all be closed or else none can operate. At any time during the cycle of operations, the entire equipment can be stopped immediately by pulling a cord that controls all the solenoids. One pump supplies pressure for all the hydraulic cylinders on the automatic loaders and on the machines.

Loading arrangements of the type described are also applicable to long rows of similar machines, provided the machines can be loaded from overhead.

The above layout (Fig. 2) is proposed for machining armature shafts without a person touching them after they have been cut from the bar stock. Nine operations are proposed for the shaft in the following sequence: Cut off, center both ends, rough-turn one end, rough-turn the opposite end, mill slots, finish-turn one end, finish-turn the opposite end, grind one end, and grind the opposite end. The shaft will then be deposited by the extreme right-hand loading device on a chute that leads to a conveyor.

In this sequence, the shafts must be swung end for end three times. Also, after each piece has been lowered into line with the centers of the machines, it is necessary for the work-transfer fingers of the loading heads to move horizontally a short distance into line with the machine centers, in order to enter one end of each part into a chuck. Conversely, when the operation is finished, the work pieces must be moved horizontally in the opposite direction to withdraw them from the chucks before they can be lifted vertically.

All of these head movements can be accomplished by means of equipment such as illustrated diagrammatically in Fig. 3.

At the end of the work loading equipment there is shown a hydraulic cylinder A having a piston rod with rack teeth that engage pinion B. The pinion is mounted on a shaft having a crank that operates two connecting rods C, to which all the loading heads are attached, and which impart the necessary movement for carrying the heads back and forth between the respective machines.

The second connecting rod operates a bar having rack teeth D in three places, to engage a gear on each of the heads that must turn the work end for end, as already mentioned. Thus, while the heads are moved from one machine to the next, the rack teeth are also moved horizontally at a different rate, so as to swivel the head transfer fingers and the work through 180°. The in and out movements of the transfer fingers, when they are in line with the machine centers, are accomplished by means of the hydraulic cylinder E, which supplies power for actuating a rack connected to the structural carriage that supports all the loading

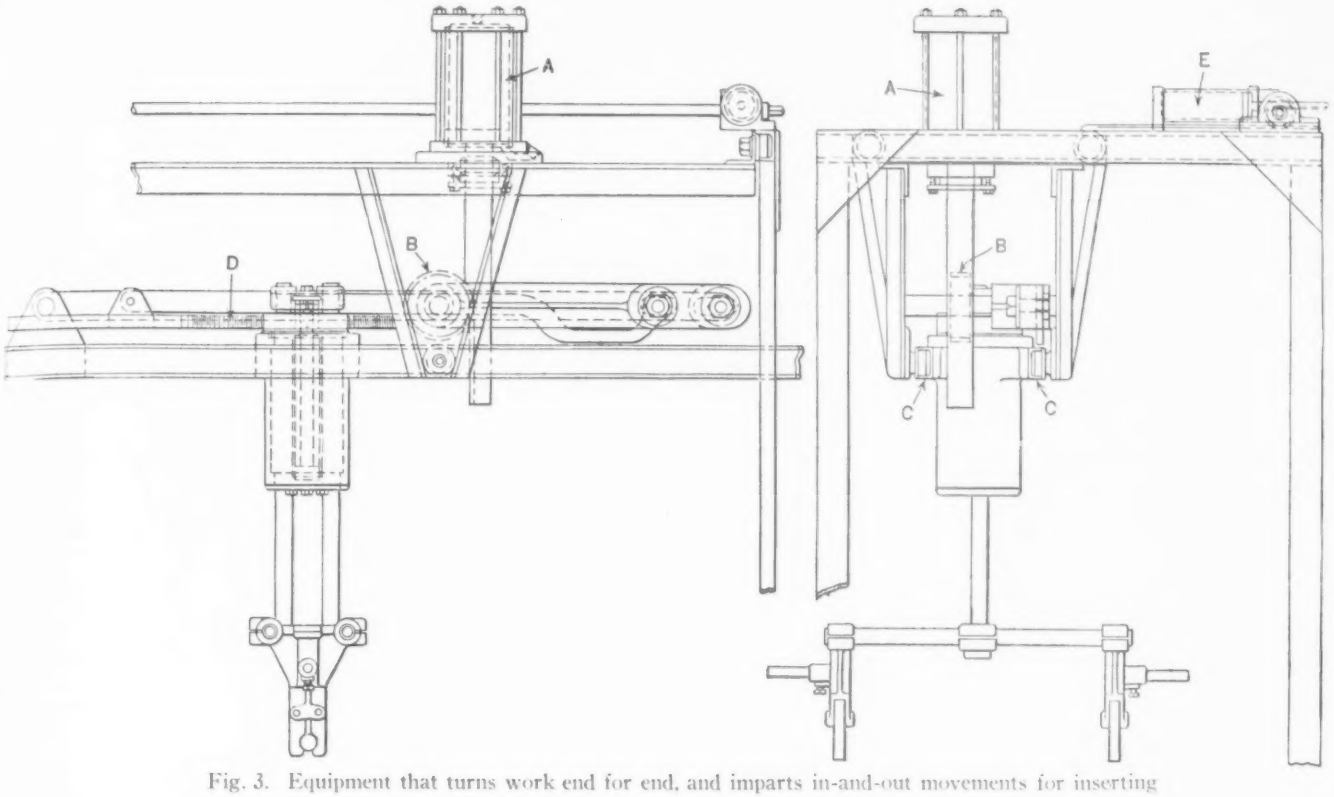


Fig. 3. Equipment that turns work end for end, and imparts in-and-out movements for inserting the pieces into the chucks and removing them.

heads. The transfer fingers of this equipment are also opened and closed by clamps actuated through hydraulic equipment on the individual heads.

Automatic loaders can also be applied to machines installed end for end, or for feeding machines in which the work does not revolve, such as milling machines.

They can be operated hydraulically, electrically, or mechanically. It has been shown that the reloading time can be reduced to a few seconds in certain types of operations, and the reloading time remains constant hour after hour because the loader does not become "tired" towards the end of the day, as an operator necessarily does. Also, time is not lost by stopping the machine every once in a while during the day for brief rests. An operator naturally becomes fatigued, because even with light pieces such as automobile steering gear sector shafts, he will lift about 4800 pounds per 8 hour day.

DEVELOPMENT OF DIAMOND AND CEMENTED CARBIDE BORING AND ITS EFFECT UPON THE INDUSTRY

(Talk delivered at ASTE meeting, September 8, 1932, by C. A. Birkebak, Mechanical Engineer of Ex-Cell-O Aircraft & Tool Corporation, Detroit, Michigan.

HISTORY OF FINISHING HOLES UP TO PRESENT TIME

Among the present day production and tool problems, the finish boring of holes to obtain proper limits as to size, roundness, and straightness, thereby making parts interchangeable, is very important. This applies not alone to bearings requiring a running fit, but to other closely fitted parts as well.

During past years, various methods have been employed for finishing bores for bearings and close fits such as boring, reaming, broaching, and grinding. Usually, boring with the ordinary type of fly tool was far too slow, and therefore expensive.

Reaming has been used quite extensively, but has not been entirely satisfactory. The solid type of reamer does not hold size very long, and therefore the tool cost becomes high, while the expanding type of reamer generally has a high tooth and produces a hole with a spiral of high and low spots. In fact, it is very difficult to produce and grind a reamer with an even height of tooth. A reamer has a tendency to follow the rough hole, and will not cut itself clear to right the error of the rough hole. Many varied types and constructions of reamers

have been designed and made to produce better finish and accuracy in finish reamed holes, some with spiral flutes and staggered teeth to prevent chatter, but as the hardness and toughness of material changes, so does the cutting ability of the reamer, and the size of the finished hole changes with it. In parts with fairly thin and uneven sections the finished hole will show out of round after the reamer is through, as a reamer exerts considerable cutting pressure due to the width of the cutting edge in contact with the wall.

Broaching is used extensively for the finishing of holes, and in many cases where parts are of rugged wall construction with heavy even sections so they can be properly supported it is very successful, but due to the pressure of cut a number of parts with light or uneven wall construction cannot be finished to proper roundness and straightness with this method.

In finishing a bearing bore in non-ferrous material, grinding is unsatisfactory as the wheel loads up quickly and also causes the wall to become charged with abrasive particles which naturally cause excessive initial wear of mating parts in assembly. This same condition holds true to some extent on bores in cast iron.

The matter of loading and swinging parts on a face plate fixture mounted on the nose of the work spindle, is in many cases objectionable as parts are so shaped that counterbalancing is necessary to keep the work spindle running true to produce round holes.

Grinding is a comparatively slow operation, and as a grinding machine is of single spindle design, a considerable amount of equipment is required in a high production plant.

Let us now consider any of the finishing methods mentioned when finishing two holes accurately in line or parallel with each other. In order to ream the two holes in accurate relation and parallel, it will be necessary to hold the part in a fixture and clamp it solid so as to withstand the cutting pressure of the tools. This clamping must be done without any distortion of the part, as otherwise the part will spring back into normal position when released and the finished holes will be out of line. In addition, it will be necessary to pilot the reamers, and when wear sets in, the pilot shanks will be loose in the piloting bushings and inaccuracy will result. These problems are in addition to the trouble of keeping the reamers cutting to size.

To take care of the production in the line, perhaps six of these reaming set-ups are necessary, which means that twelve reamers must be kept cutting to exact and uniform size, and six different fixtures must be kept up in order to obtain the desired limits as to size and proper alignment and parallelism with interchangeability at the assembly line, or for service in the field. Broaching two holes parallel is quite a difficult problem in regard to most parts, as the broaching pressure is excessive. It would be necessary to rest the part on its fixture and hold it in such manner that the broaching pressure would not cause it to twist or spring while the broach is passing through. To obtain this condition, parts would require costly finishing operations for location not needed otherwise.

To accurately grind two holes parallel would require two set-ups or shifting of the part, grinding one hole at a time. Fixtures would have to be maintained accurate, and when loading parts care would have to be taken that the locating and clamping faces are kept clean; also locating and clamping faces must be guarded against nicks and damage in process.

This method is rather slow and expensive, and has plenty of chance for error due to the double loading and handling.

DEVELOPMENT OF TOOLS

Along with the discussion of different methods of finishing let us review the tools, or rather the material from which finishing tools have been made.

It is not so many years ago that high speed steel was brought into common use, in fact, many of us here remember the time when most cutting tools were made from carbon or tool steels. As industry progressed, the demand for better tools and materials increased, and particularly so as the automotive industry advanced. As motor cars were built for higher speeds and the plant was called upon for more production and greater accuracy, better tools with longer life were demanded. The first step forward in tools was high speed steel which in turn was developed to a high degree of uniformity. This greatly increased the life of tools, and with the longer tool life greater accuracy was possible in the finished parts.

Later, Stellite was developed and put on the market. This material found many successful applications at feeds and speeds greatly in excess of those applied to high speed steel.

As the aircraft industry developed, and the automotive industry advanced toward its present day state of perfection, the call was for higher speeds with smoothness and durability, necessitating better finishes and accurate interchangeable fits of the component parts.

This demand has within a short length of time brought about the development of new materials—tungsten and tantalum carbides—and their application as cutting tools. It has also brought about the use of diamonds for precision boring and turning tools, and the development of boring machines designed for the application of diamond and the carbide tools to production problems.

A few years ago the use of diamond tools in precision boring was started. The diamond tools under proper machine conditions were found to produce accurate bores with a very high finish, and the tool life exceeded that of any other known tool to such an extent that the possibilities of diamond boring were very apparent. At the very start, proper machines were not available for this operation, and special equipment generally built on a lathe or grinder bed was used.

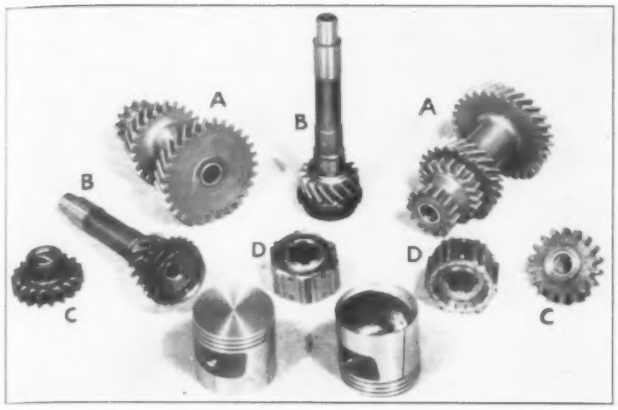


Fig. 1. Some typical diamond boring jobs.

Due to the spindle speed possible and desirable in diamond boring, the accuracy and the upkeep of spindles was a principal problem, as it was necessary to have spindles closely fitted for radial and end play so that they would operate smoothly and without vibration.

The secret of our success in solving the diamond boring spindle problem lies in the specially designed High Speed Ball Bearings with which our spindles are equipped.

This bearing was designed and produced for specific purposes and is extremely accurate. The method used in fitting these bearings enables us to hold radial and end play to very close limits, and with these close limits the bearings give accuracy and long life.

As a result of the experience with these spindles, diamond boring soon became of importance in the Ex-Cell-O organization, and early in 1928 work was started on the development of a standard diamond boring machine properly constructed to meet the requirements in the diamond boring field.

Extensive research work and study resulted in finding a very large list of parts of different materials such as aluminum, bronze, babbitt, and bakelite, also cast iron and steel, which could be finish bored practically and profitably by the diamond boring method.

In developing the Diamond Boring Machine it was necessary to consider the design of fixtures with the view of handling as nearly as possible the complete range of parts; provide for adjustments so that both large and small fixtures could be used to best advantage; and at the same time keep the appearance of the machine within the right proportions. The machine is built in two models: a single end machine, No. 112 A; and a double end machine, No. 216 A (Fig. 2).

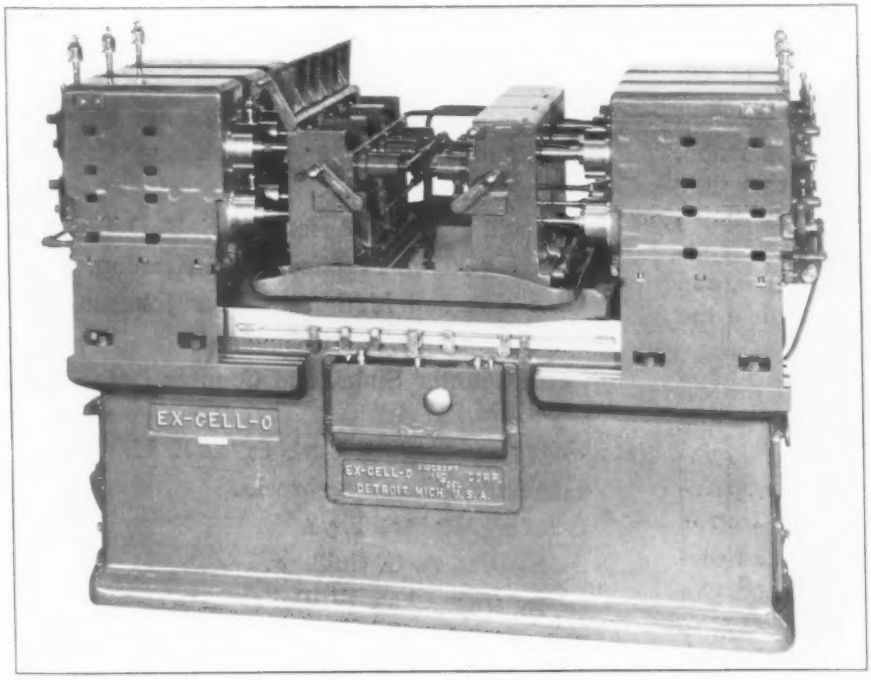


Fig. 2. Double End Diamond Boring Machine.

These machines are hydraulically operated, and the standard spindles used are interchangeable. All revolving parts such as spindles are kept stationary, and are fastened to the base as one unit. Only the inanimate parts, such as the work holding fixture, are movable. The hydraulic system operates at 100 pounds pressure per square inch. A large variety of fixtures can be used, either cam or hydraulically operated with hand or automatic control.

The spindles are of the in-built motor type using a shaftless type of balanced motor. The rotor is balanced on the spindle shaft, and the stator is mounted in the spindle bracket. The spindles have three special high speed ball bearings, and are built for speeds at 1800 and 3600 rpm.

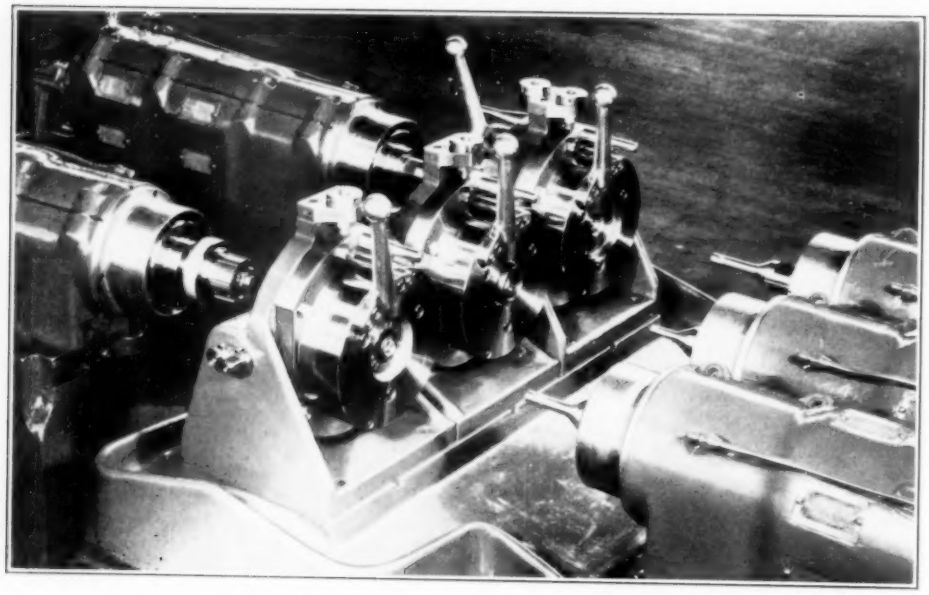


Fig. 3. Close-up view of fixtures and spindles.

MATERIAL TO BE BORED

This boring machine has applications for many varied parts and kinds of material, non-ferrous, cast iron, and steel. Each kind of material is a separate problem in itself as to feed, speed, and tools. In most non-ferrous materials, such as aluminum alloy, bronze, and babbitt, a diamond tool is the most successful. On these materials high speeds and low feeds are used to produce the desired finish. In obtaining a finish on all of these materials the tool shape is of vital importance. As analyses of these materials vary, the tools shapes must be changed to get the highest degree of finish. In nearly all cases of boring non-ferrous materials, a soluble oil solution is used. This prevents heating of the tool setting, which results in a very slight expansion. It also flushes the chips out of the way so that they do not pick up on the tool quills and mar the finish of the bore. The feeds used in boring non-ferrous materials vary according to the individual job, and depend somewhat upon the tool shape used in the boring operation.

In the boring of cast iron the range of critical speeds is quite close, and must be suited to the diameter and material in the parts. For this operation, tungsten carbide tools are used, and the operation is performed dry. The analysis of the iron is quite important in considering tool shapes and tool life. However, accuracy as to roundness and straightness of bore has been obtained successfully through the application of the precision boring machine.

In regard to the boring of steel, Ex-Cell-O has made several very successful applications. On this material, the same as on cast iron, the critical speeds are very close and depend upon the analysis and the hardness of the material to be bored. The tool shapes must also be closely controlled and reproduced during the life of the tool. The finish obtained on the different applications has been much better than any ground finish obtainable, and the accuracy as to roundness and size is greater than in grinding.

The boring of iron and steel is new, and constant experiments are being conducted on these materials to obtain better tools with longer life, which means closer limits in the finished bored parts. In these experiments marked success has been obtained, and feats in the experimental room indicate promising results in this development work.

STANDARDIZATION COMMITTEE

A Standardization Committee has been appointed by President J. A. Siegel. Mr. E. C. Lee is the General Chairman of the new committee. Chairmen of the various Sectional Committees are as follows:

Jigs and Fixtures and Machining Committee, L. K. Rosenberg.

Jigs and Fixtures, Assembly, E. R. DeLuiz.

Drawing Room Practice, H. E. Kraning.

Operation and Methods, Elmer Johnson.

Milling Cutters, A. M. Goddard.

Drill, Counter Sinks, and Counter Bores, Carl J. Oxford.

Gages and Gaging Methods, E. E. Marlin.

Machinery, Cass Dombroski.

Grinding, Robert Frye.

Small Dies, A. G. Gulberg.

Large Dies, Chas. W. Balle.

Forging Dies, Harry M. Howe.

Turning and Boring Tools and Holders, J. B. Giern.

Tool Engineering Bulletin No. 7

MACHINING OF MONEL METAL

Monel metal is an alloy of Nickel and Copper, containing about 68% Nickel, 30% Copper and 2% of other materials, principally Iron.

Monel is not a hard material, but is very tough, and for that reason moderate feeds and speeds should be used when machining. Surface speeds of from 45 to 65 feet, should be used, depending on the machining conditions and depths of cuts. Feeds comparable with those used for cutting alloy steels are suitable for this material.
The following specific recommendations are made for machining Monel metal:

DRILLING

Use the standard type of Twist Drill. Speeds 40 to 60 feet. Feeds .006 for ¼" drill, .010 for ½" drill, .013 for 1" drill; other diameters of drills in proportion. For deep holes a polished flute and somewhat heavier web is advisable. Ample back taper should be provided, because this material picks up easily on the margin of the drill. Use regular point angle and lip clearance. Do not attempt to use drill after it shows appreciable signs of dulling.

REAMING

Use reamers of the spiral type if possible. Speeds of 10 to 15 feet are recommended. Feeds should be lower than those used for steel, because with heavy feed the material will load on the cutting edges. Use reamers with narrow lands and well polished flutes.

MILLING

Use milling cutters with 10° to 15° rake angle, and with the regular number of teeth. Speeds should be from 50 to 65 feet. Feed from two to five inches per minute, depending on the depth of cut. See that cutters have keen edges and sufficient clearance at all times. For slotting cuts provide ample side clearance to prevent gumming and picking up of material on the sides of the cutters.

— — —

For coolant a good mixture of soluble oil or its equivalent are giving the best results.

Courtesy of C. J. Oxford.

National Twist Drill & Tool Co.
Detroit, Mich.

Tool Engineering Bulletin No. 8

DRILLING OF ALLEGHANY METAL

The manufacturers of Alleghany Metal, which is a stainless steel of the 18-8 Chromium type, have made the following recommendations for the drilling of this material:

"A high speed drill should be used for this material, with the point ground somewhat flatter than the standard. Lay-outs should be made with a triangular-nosed center-punch, taking care not to make the mark deeper than necessary, in order to avoid work-hardening and thus making it difficult to start the drill. On account of the work-hardening characteristics of Alleghany metal, it is necessary to exert sufficient pressure on the drill to make it cut all the time.

It is very important that this metal be properly backed up, because it does not chip or break out ahead of the cutting point of the drill, as does ordinary steel, and the drilling must be done all the way through. The speed of the drill should be about one-half that used for mild steel. Immersing the drill in water after each hole is drilled will prolong its life considerably.

The low-speed electric hand drills recently brought out by several manufacturers are much better for drilling this metal than the older types, in which the speeds were too high. The drill must be kept cutting when in contact with the work to prevent work-hardening. In drilling deep holes, a compound of one pound sulphur to one gallon of lard oil will prove advantageous."

Courtesy of C. J. Oxford.

National Twist Drill & Tool Co.
Detroit, Mich.

AN ADAPTATION FOR A BORING MACHINE

By Peter F. Rossmann, Packard Motor Car Company

Carry the boring mill to the work. The hand boring unit shown below permits this and more. It relieves the regular boring equipment from overtime during rush periods, saves considerable set-up time in many instances, and saves handling time on large parts.

Application:

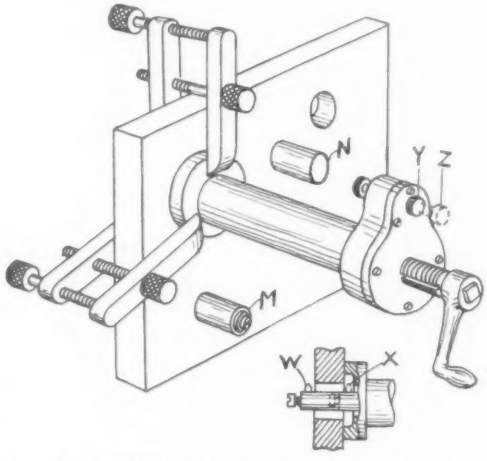


Fig. 1. Hand boring tool set-up on work. Location is made from buttons M and N to flange on tool. The flange is made true with the boring bar.

OPERATION

After being set up as shown in Fig. 1, with tool bit in position W, shift differential gear shaft (2) to position Y, and turn boring bar (15) by means of crank (8). Gear (12) is turned by key (13), and drives gear (3). When shaft (2) is in position W, gears (4) and (5) are keyed together. Gear (5) drives gear (11) which has a threaded bore engaging the thread on the boring bar thus feeding the tool.

Formula for determining boring bar feed:

Let a = gear (12); b = gear (4); c = gear (5); d = gear (11), e = lead of thread on boring bar.

$$c - \left(\frac{ac}{bd} \times e\right) = \text{feed.}$$

Example: Assume the boring bar to have 20 threads per inch (lead 0.050); gear a to have 35 teeth; gear b, 14 teeth; gear c, 13 teeth; and gear d, 36 teeth.

Details:

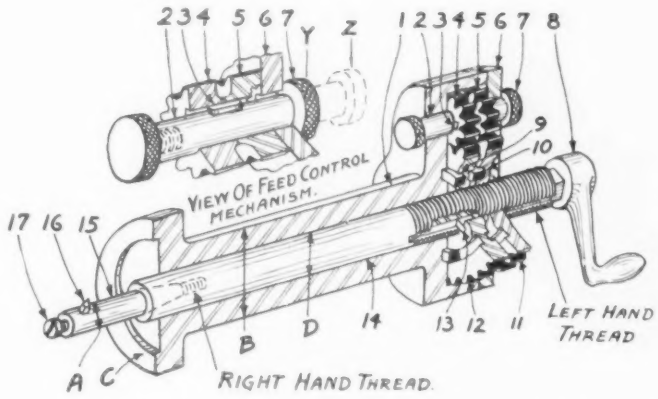


Fig. 2. No. 1—Body. No. 2—Feed change and differential gear shaft. No. 3—Locking key. No. 4—Differential drive gear. No. 5—Differential feed drive gear. No. 6—Gear housing cover. No. 7—Feed change shaft stops. No. 8—Operating crank. Nos. 9 and 10—Spacers and bearing rings. No. 11—Driven feed gear. No. 12—Differential drive gear. No. 13—Key. No. 14—Feed shaft. No. 15—Boring bar. No. 16—Tool bit. No. 17—Clamp screw.

$$0.050 - \left(\frac{35 \times 13}{14 \times 36} \times 0.050\right) = 0.050 - 0.04513 = 0.0048\text{" feed.}$$

The rain it raineth everywhere,
Upon the just and unjust fellers,
But mostly on the just because
The unjust got the just's umbrellers.

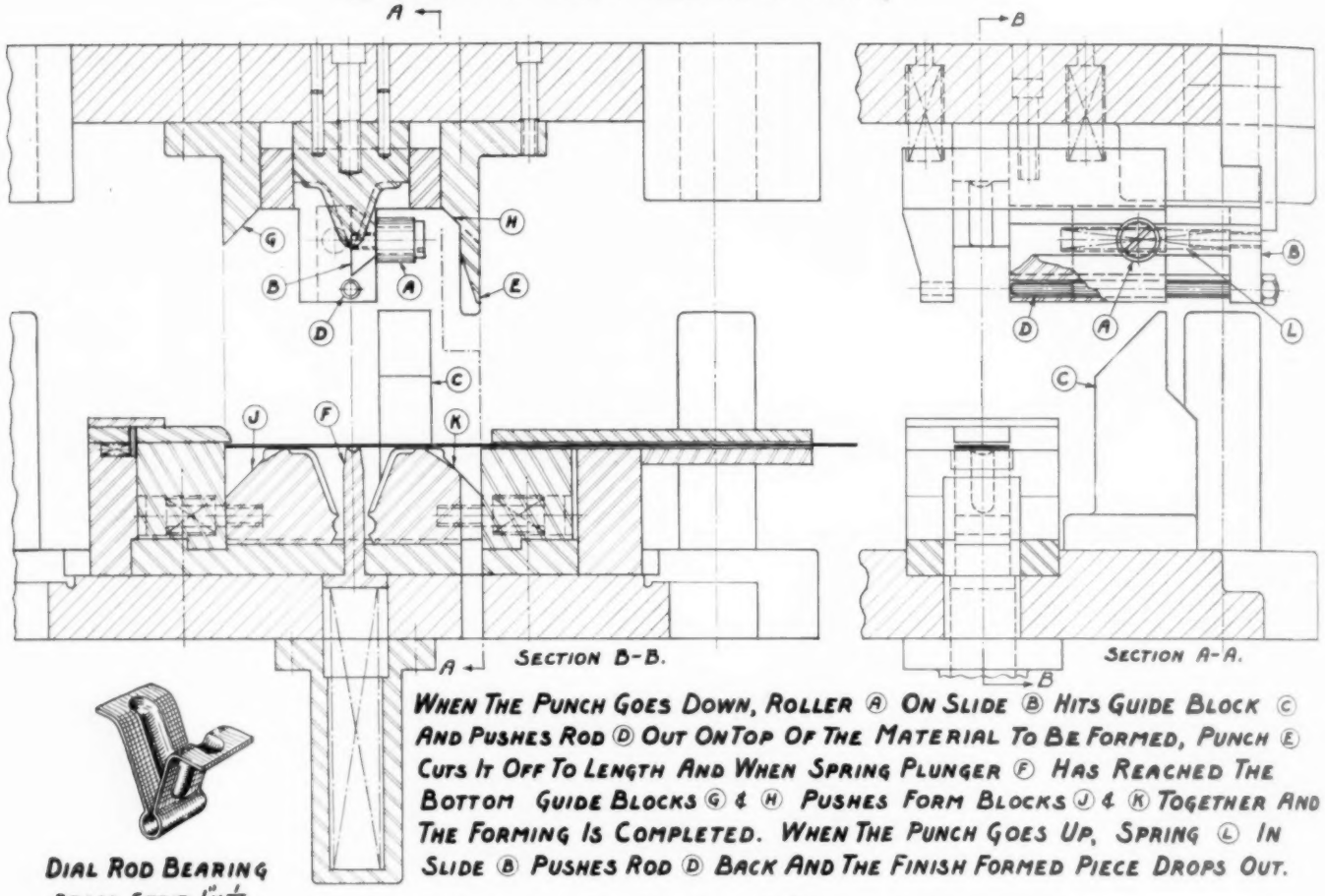
It was the first real snowstorm of the year and the teacher felt it her duty to warn her pupils before she dismissed them.

"Boys and girls should be very careful to avoid colds at this time of the year," she said solemnly, "I had a darling little brother only seven years old. One day he went out in the snow with his new sled and caught cold. Pneumonia set in and in three days he was dead." The schoolroom was so quiet you could hear a pin drop. Then a youngster in the back row asked: "Where's his sled?"

"I have spent nearly $20,000 on that girl's education," complained the aggrieved father, "and here she goes and marries a young feller with an income of only $1,000 a year."

"Well," said the friend of the family,, "that's 5 per cent on your investment. What more can you expect in these times?"

DIE TO CUT & FORM DIAL ROD BEARING.



SECTION B-B. SECTION A-A.

DIAL ROD BEARING
BRASS STRIP 1" X 1/32

WHEN THE PUNCH GOES DOWN, ROLLER Ⓐ ON SLIDE Ⓑ HITS GUIDE BLOCK Ⓒ AND PUSHES ROD Ⓓ OUT ON TOP OF THE MATERIAL TO BE FORMED, PUNCH Ⓔ CUTS IT OFF TO LENGTH AND WHEN SPRING PLUNGER Ⓕ HAS REACHED THE BOTTOM GUIDE BLOCKS Ⓖ & Ⓗ PUSHES FORM BLOCKS Ⓙ & Ⓚ TOGETHER AND THE FORMING IS COMPLETED. WHEN THE PUNCH GOES UP, SPRING Ⓛ IN SLIDE Ⓑ PUSHES ROD Ⓓ BACK AND THE FINISH FORMED PIECE DROPS OUT.

BY COURTESY OF MR. FLOYD B. PETTEYS. PLANT ENGINEER.
COPELAND PRODUCTS, INC., MOUNT CLEMENS, MICH.

NEWS NOTES OF THE INDUSTRY

Factory shipments of Rocknes to dealers in August gained 38.3 per cent over the July total, according to George M. Graham, vice president of the Studebaker subsidiary. Another optimistic note came from J. C. Chick, general sales manager of Cadillac, who reported: "Our sales figures for August bear out the conclusion that buying spirit is increasing. For the first time in many years our August sales have exceeded those in July, and this remarkable seasonal upturn gives every evidence of continuing through September." The noticeably better position of the high priced manufacturers was attributed directly to stock market activity.

L. A. Miller, president of Willys-Overland, has acknowledged that his organization and the International Harvester Company of Chicago are negotiating with the object of combining sales and manufacturing programs. Mr. Rumor in Toledo has it that Willys-Overland will produce a passenger vehicle to sell at about $400, to make a definite appeal to farmers, and to be distributed through International Harvester's 200 branches as well as through Willys dealers.

Walter P. Chrysler has announced that Skinner Motors, Inc., Detroit, manufacturers specializing in Ford parts, have just been granted a non-exclusive license to sell floating power engine mountings as replacement parts for Ford cars.

The National Machine Tool Builders' Association's index of machine tool orders gained three points in August, rising to 28.3 from 25.3 in July, *Iron Age Magazine* reports. "There is undoubtedly greater interest," the report reads, "among machinery users in prospective purchases, but thus far this interest has not been translated into much business. Of all the industrial areas of the country, New England appears to be the most promising, chiefly because of the rise in textile activity in that section."

A TOOL ENGINEERING PROJECT

By SVERRE BERG, FLOYD CARLSON, CLARENCE ERICKSON, HERBERT ROYLE, LEONARD SPRENGER, TOM TOMAKICH, KENNETH WATSON, and LOUIS WOKAS.

(Continued from last issue)

Fig 20 shows the machine used for drilling the four holes in the base. The formula

$$T = \frac{60 \times L}{N \times F}$$

gives us the maching time.

$$T = \frac{60\ (.375 + .108)}{490 \times .008} = 7.4 \text{ seconds.}$$

The length of the drill cone, 0.108", was added to the depth of the hole.

Fig. 20. Leland-Gifford Drill Press used for drilling four 13/32" holes in Base.

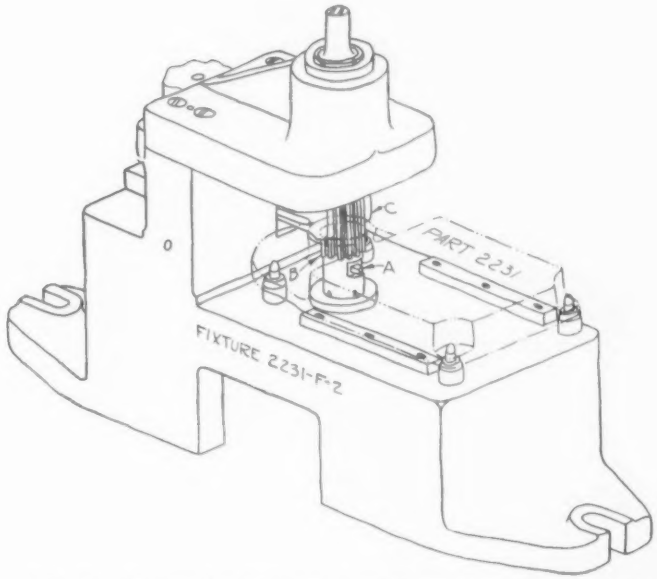


Fig. 21. Fixture for boring and reaming column hole in Base.

For boring and reaming the column hole in the third operation, the boring tool A and the reamer B in Fig. 21 are attached to the same bar, allowing the operation to be performed in one pass. The clamp C, which presses on the top of the column hole boss, is cut away to allow the passage of the reamer B. A Leland-Gifford Drill Press of the type shown in Fig. 20 is used for this operation.

The formula below gives the machining time. The number of revolutions per minute was found by using the formula

$$N = \frac{12\ C}{\text{pi}\ D}$$

where C is the cutting speed in feet per minute and D the diameter of the hole. From a Kearney and Trecker data sheet 250 ft. per minute was arrived at as the proper cutting speed for tungsten carbide on cast iron, and 0.015" per revolution as the feed.

$$N = \frac{12 \times 250}{5.5} = 545.4$$

$$T = \frac{60 \times 1.75}{545 \times .015} = 12.8, \text{ say } 13 \text{ seconds.}$$

Allowing 11 seconds for the manipulations of the operator, we get a floor to floor time of 24 seconds.

Milling the top of the base is the fourth operation. The rotary miller shown in Fig. 22 is used for this

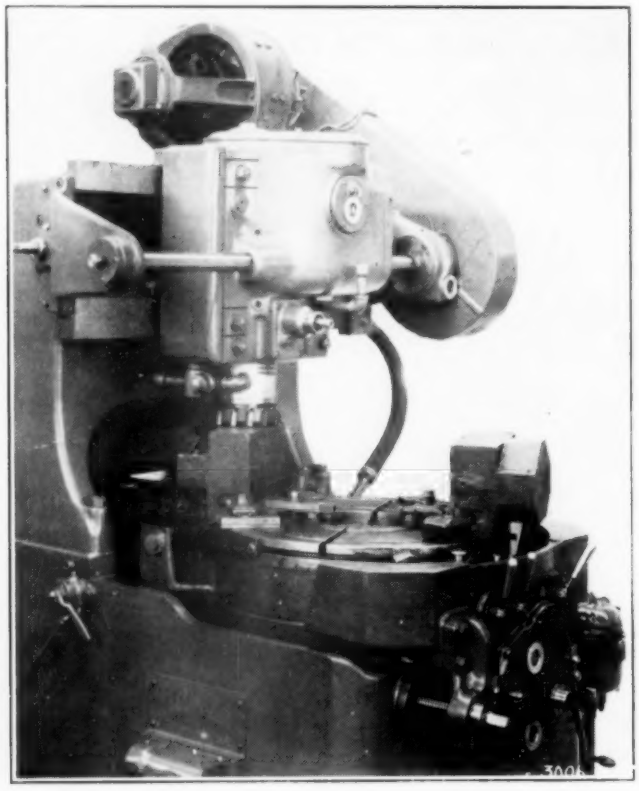


Fig. 22. Cincinnati Rotary Miller used for milling top of Base.

operation. The miller is equipped with six fixtures (Fig. 23) and a 10" diameter cutter. It was calculated that six fixtures would be necessary to get the desired production, and a machine with the proper size of table was chosen so that the six fixtures could be accommodated. The disc ground bottom face of the part rests on two hardened and ground steel plates A. The base is located by means of the pin D and the pilot C, and held down by three clamps B.

A Kearney and Trecker data sheet recommends a cutting speed of 250 ft. per minute, and a feed per tooth per revolution of .010", in connection with the 1/16" depth of cut which was chosen. The cutter rpm. will be

$$\frac{12 \times 250}{10 \text{ pi}} = 96.$$

The table feed per minute will be the number of teeth times the feed per tooth per revolution times the rpm.

$$24 \times .010 \times 96 = 23" \text{ per minute.}$$

The length of the base to be milled is 9 3/16", but 9 1/2" will be actually traversed by the table of the miller. Dividing 9.5 by 23 and multiplying the quotient by 60 will give the machining time, 24 seconds. There will be no floor to floor time, as the operation is continuous.

From the standpoint of extreme accuracy, the operation of milling the top should precede the boring operation, when it is considered that a tendency exists for the casting to warp after its base is ground. However, with a tungsten carbide cut of only 1/16" the consequent warpage would not be sufficient to cause the column bore to be very much out of perpendicular with the top face. The present method was decided upon because of the saving in labor. Since the drill press we are manufacturing is not designed for fine precision work our method is accurate enough for our purpose.

The fifth operation is tap drilling the 3/8" hole. The same kind of machine as shown in Fig. 13, (Avey drill press—see Sept. Journal) is used for the operation. Fig. 24 shows the fixture. The part is slipped over the plug A and the two pins C, and pushed against the plate B. The C-clamp D fits over the neck of plug A, and holds the base in position for drilling.

A feed of 0.008" per revolution, and an rpm. of 612 are used. The formula

$$T = \frac{60 \times L}{N \times F}$$

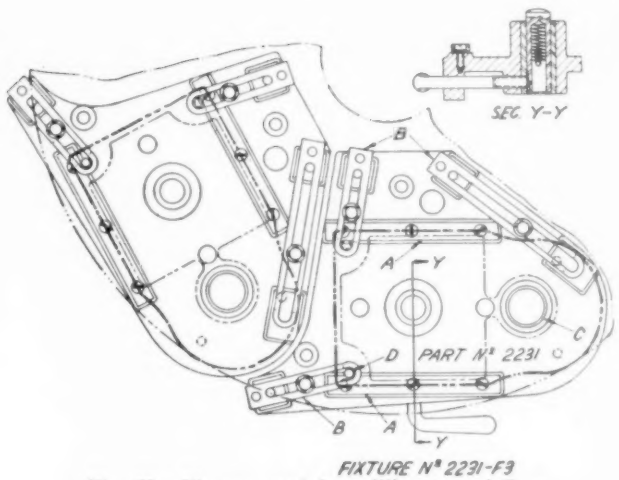


Fig. 23. Fixture used for milling top of Base.

gives the drilling time.

$$T = \frac{60 \ (.5 + .09)}{612 \times .008} = 7.3, \text{ say 8 seconds.}$$

To this time is added 4 seconds for loading the fixture.

Operation No. 6, performed on the same kind of machine as shown in Fig 15, (Avey Tapper, see Sept. Journal) is tapping the 3/8" hole. The fixture for the previous operation with bushing removed is used for this operation. We used 197 rpm. as the speed of the tap. Dividing 60 seconds by 197 gives 0.3 seconds per revolution. The hole to be tapped is 1/2" deep, requiring about 10 revolutions of the tap. The actual tapping time will be 10 x 0.3 = 3 seconds. To back the tap out of the hole will require another 3 seconds. Adding 4 seconds for unloading the fixture, the total floor to floor time will be 10 seconds. One operator performs both

the tap drilling and tapping operations. Two machines are used, and the fixture slides from one machine to the other.

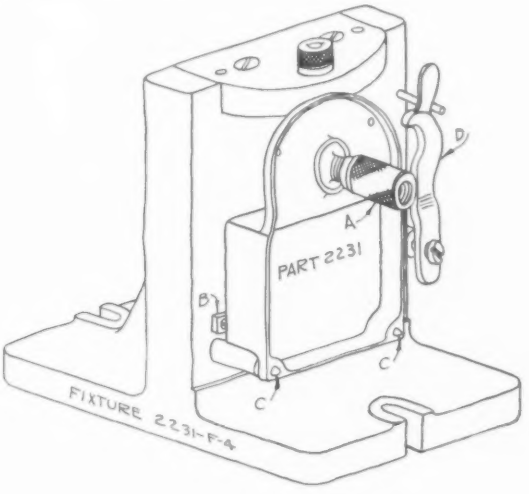


Fig. 24. Fixture used for tap drilling hole in column boss of Base.

REDESIGN OF SPINDLE

The original design of the spindle of the drill press was as shown in Fig. 25. To reduce the cost of machining this part, we altered the design of the detail to the extent of reducing the diameter of the collar at A from $13\frac{1}{16}$" to 0.635".

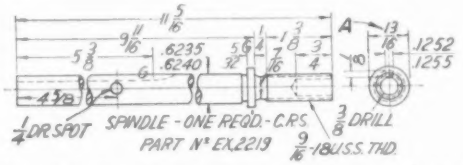


Fig. 25. Spindle of Drill Press showing original design.

The question arose as to whether we should form the collar by using an electric welder for upsetting, and whether we should make the threaded end in an automatic screw machine, to be butt-welded to the remainder of the spindle. An increase in cost would have resulted if these suggestions had been followed, due to the greater expense involved in turning and grinding to overcome eccentricity.

It was necessary to test the strength of the new diameter collar. The pressure required for driving a $\frac{3}{8}$" drill, the maximum capacity of our drill press, through hard steel is 700 pounds. The pressure required for forcing the thrust ball-bearing over the 0.010" collar was calculated as 2 tons. Hence, the new design was found to be amply strong.

The cost of making the spindle as called for in the original design was $0.0911, while the new design enabled the detail to be made for $0.0690. In a year, during which 300,000 are produced, this amounts to a saving of $6,630.00.

(continued next issue)

Mr. Earl Harrison has severed his connection with the Barker Tool Company, with whom he has been connected as Sales Manager for the past five and a half years. Mr. Harrison is contemplating opening up an office as manufacturers' agent, having tentatively contacted several established accounts.

All world's automobile records for sustained high speed were shattered recently by a current model Pierce-Arrow 12 cylinder roadster, when Ab Jenkins, noted driver and research engineer, speed 2,710 miles around a circular course in 24 hours, maintaining an average of 112.91 miles per hour. Jenkins did not leave his seat in the car during the entire 24 hour period, and his only stops were brief ones for refueling.

The run was made on the salt bed at Salduro, Utah, 120 miles from Salt Lake City, and was sponsored and authenticated by the Salt Lake City Chamber of Commerce. Jenkins swept all land records, including the Indianapolis Speedway mark established by Fred Frame in this year's Memorial Day classic, far into oblivion.

The Majestic Tool & Manufacturing Company, 2650 Popular Street, Detroit, Michigan, Manufacturers of PARKER HI- SPEED BEARINGS and GRINDING SPINDLES, have recently developed and marketed a direct motor driven spindle for the No. 2 Brown & Sharpe Surface Grinder.

This spindle, which is driven with a $\frac{3}{4}$ H.P. motor at 3450 rpm. under full load, is producing excellent results.

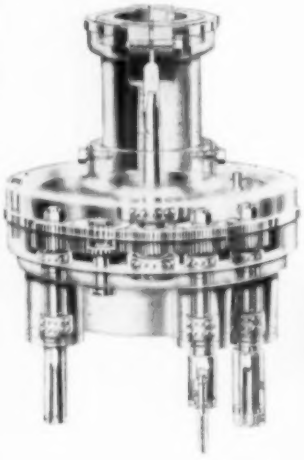
For grinding splines, slots, keyways, grooves, etc., where the side of the wheel is used, there is no necessity for nursing the spindle along with a stick or end of brush handle in order to avoid end play. Since there is no end play, the operator's attention may be concentrated entirely on his grinding.

To adopt this type spindle to the standard spindle housing requires only reboring housing to diameter of 3", drilling and tapping a $\frac{3}{8}$" set screw hole in lower part of housing face, and spotting onto the spindle for set screw.

ANNOUNCEMENT

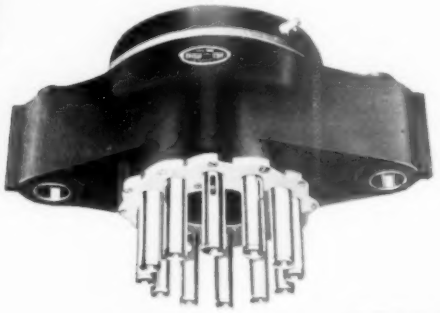
That I have discontinued my connection with the Surplus Material and Machinery Co., and have opened a new store at 7800-7810 Mack Avenue, corner Seyburn. Phone Whittier 3913, with a full line of New and Used Machinery, Electric Motors, Power Transmission and Shop Equipment. I offer my services to my Friends and customers to whom I offer many thanks for past favors.

CHAS. E. WAIN MACHINERY SALES



Krueger Multiple Drill Heads

BUILT for all types of multiple operations—drilling, reaming, counterboring, countersinking, tapping and similar operations.



All products—drill heads, jig plates, fixtures, rotary tables, etc.—are designed and built to meet specific production requirements.

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An Irishman on his deathbed called to his wife and exclaimed:

"Bridget, I smell corn beef and cabbage cooking. Bring me a dish of it, will you?"

"Shure, and I will not," Bridget replied. "I'm saving that for the wake."

PREPARATION IS THE THING

As capacity is enlarged, production is increased. This is true of humans as well as plants.

The reward of work well done is more work to do, and faithfulness to responsibility brings added responsibilities. This is the natural law.

You do not expect a pint pitcher to hold a quart of milk, and you should not expect a job higher up unless you have prepared yourself for it.

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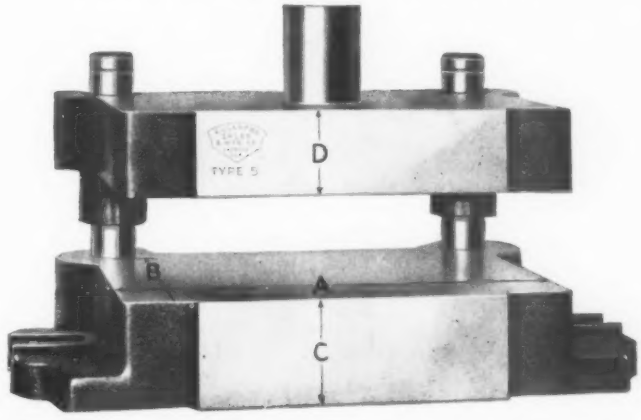

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